IEC 62341-6-1

Edition 4.0 2025-05

INTERNATIONAL STANDARD

Organic light emitting diode (OLED) displays –
Part 6-1: Measuring methods of optical and electro-optical parameters

ICS 31.260

ISBN 978-2-8327-0395-3

IEC 62341-6-1:2025-05(en)

CONTENTS

FOREWORD 6
1 Scope 8
2 Normative references 8
3 Terms, definitions and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 9
4 Structure of measuring equipment 9
5 Standard measuring conditions 9
5.1 Standard measuring environmental conditions 9
5.2 Standard measuring dark room conditions 10
5.3 Standard setup conditions 10
5.3.1 General 10
5.3.2 Adjustment of OLED displays 10
5.3.3 Starting conditions of measurements 10
5.3.4 Measuring equipment requirements 10
5.4 Standard locations of measurement field 12
5.5 Standard test patterns 13
6 Measuring methods for optical parameters 17
6.1 Primary luminance, colour, and uniformity of full-colour high-resolution displays 17
6.1.1 Purpose 17
6.1.2 Measuring conditions 18
6.1.3 Measuring methods for high-resolution full colours 18
6.1.4 Maximum luminance of white and RGB primaries 19
6.1.5 Average colour of maximum white and RGB primaries 19
6.1.6 Luminance uniformity of white and RGB primaries 20
6.1.7 Chromaticity non-uniformity of maximum white and RGB primaries 21
6.1.8 Colour additivity of maximum white and RGB primaries 21
6.1.9 White correlated colour temperature 21
6.2 Primary luminance, chromaticity and uniformity of low-resolution displays 22
6.2.1 Purpose 22
6.2.2 Measuring conditions 22
6.2.3 Measuring methods for low-resolution displays and segmented displays 22
6.3 Signal loading 23
6.3.1 Purpose 23
6.3.2 Measuring conditions 23
6.3.3 Measuring methods 23
6.4 Dark room contrast ratio 24
6.4.1 Purpose 24
6.4.2 Measuring conditions 24
6.4.3 Measuring method 24
6.5 Chromaticity gamut area 25
6.5.1 Purpose 25
6.5.2 Measuring conditions 25
6.5.3 Measuring methods 25
6.5.4 Chromaticity gamut area in CIE 1931 chromaticity diagram 25
6.6 Colour gamut volume 26

6.6.1 Purpose 26
6.6.2 Measuring conditions 27
6.6.3 Measuring methods 27
7 Measuring methods for power consumption 30
7.1 Purpose 30
7.2 Measuring conditions 30
7.3 Measuring methods 30
7.3.1 Measuring the power consumption relevant to luminance of the OLED display module without signal decoding process 30
7.3.2 Measuring the power consumption of the OLED display module's embedded video connection terminal with a signal decoding process 31
Annex A (normative) Response time of passive matrix display panels 34
A.1 Purpose 34
A.2 Measuring conditions 34
A.3 Measuring methods 34
Annex B (normative) Luminance current efficiency 36
B.1 Purpose 36
B.2 Measuring conditions 36
B.3 Measuring methods 36
Annex C (informative) Veiling glare frustum 38
Annex D (informative) Methods to obtain the correlated colour temperature (CCT) from chromaticity coordinates 39
D.1 Method 1: Use of McCamy's approximate formula 39
D.2 Method 2: Use of Javier Hernandez-Andres's approximate formula 39
D.3 Method 3: Graphical determination of correlated colour temperature 40
Annex E (informative) Measuring performance of modern colour-managed displays and panels 43
E.1 Legacy displays 43
E.2 Modern displays 43
E.3 Results 45
E.4 Conclusion 48
Annex F (informative) Simple window luminance and colour measurements 49
F.1 Background 49
F.2 Measuring conditions 49
F.3 Maximum full screen luminance 49
F.4 4 % window luminance 49
F.5 Sampled luminance non-uniformity 50
F.6 4 % window centre colour 50
F.7 Sampled colour non-uniformity 51
Bibliography 52

Figure 1 – Layout diagram of measurement setup 11
Figure 2 – Standard measurement positions in the display active area 12
Figure 3 – Test pattern scaling used to define the area size of the coloured rectangles in the active area of the display 13
Figure 4 – Medium APL loading series of red, green, blue, and white test patterns used for basic luminance, colour, and uniformity measurements 14
Figure 5 – Low and high APL loading versions of CTR pattern 15

Figure 6 – Standard medium APL RGBCMY test pattern used for centre luminance and colour measurements with 25 % APL 16
Figure 7 – Examples of variable signal loading RGBCMY test patterns used for centre luminance and colour measurements 17
Figure 8 – Sequence for measuring luminance and colour at the nine standard display positions for all coloured tile patterns 18
Figure 9 – Chromaticity of blackbody source at various temperatures as represented on the CIE 1931 chromaticity diagram 22
Figure 10 – Example representation of the primary colours in the CIE 1931 chromaticity diagram 26
Figure 11 – Example of range in colours produced by an sRGB display as represented by the CIELAB colour space and by visualization using gamut rings 29
Figure 12 – Example of measurement setup of power consumption 31
Figure 13 – Example of measurement setup of power consumption with embedded video terminal 32
Figure A.1 – Relationship between driving signal and optical response times 35
Figure B.1 – Example of a measurement configuration for measuring luminance current efficiency 37
Figure C.1 – Pattern for veiling glare frustum 38
Figure D.1 – CIE 1931 XYZ chromaticity diagram 41
Figure D.2 – Blackbody locus (Planckian locus) and isotemperature lines in CIE 1931 chromaticity diagram 42
Figure E.1 – Legacy model where the independent drive electronics provide a direct correlation between the input RGB signals and the display’s colour primaries 43
Figure E.2 – Examples of modern drive models using multi-dimensional LUTs for RGB (top) and multi-chromatic (bottom) displays 44
Figure E.3 – Example of signal loading behaviour for an RGBW display (top) and RGB (bottom) OLED display 46
Figure E.4 – Low APL loading test pattern with small box size (1/9 of the screen size dimensions) 47
Figure E.5 – Signal loading profiles for several input colours measured at the centre of the test pattern using Figure 8 48
Figure F.1 – Example of simple 4 % white window pattern at the centre of the screen 50

Table 1 –Standard digital-equivalent input signals for rendering the white, primary and secondary colours in test patterns 17
Table 2 – Example of luminance measured for the same colour patch at the standard nine screen positions and the resulting luminance non-uniformity 19
Table 3 – Example of the chromaticity measured for the same colour patch at the nine standard screen positions and the resulting chromaticity non-uniformity 19
Table 4 – Scaling the size of the colour boxes in the APL loading pattern relative to the screen dimensions 24
Table 5 – Example of report format for CIELAB gamut volume 30
Table 6 – Example of a module power consumption measurements summary sheet 31
Table 7 – Example of module power consumption measurements with contents 33
Table 8 – Example of module power consumption measurements with images 33
Table D.1 – $x_{\mathbf{e}}$, $y_{\mathbf{e}}$, A_i and t_i for Formula (D.3) and Formula (D.4) 40

Table E.1 – Example of luminance data for an RGB display and an RGBW OLED display 45

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –

Part 6-1: Measuring methods of optical and electro-optical parameters

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62341-6-1 has been prepared by IEC technical committee 110: Electronic displays. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2022. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The standard average picture level (APL) RGBCMY test pattern is modified, and the variable signal loading RGBCMY test pattern is added.
b) Chromaticity gamut area and colour gamut volume are modified.

The text of this International Standard is based on the following documents:

Draft	Report on voting
110/1690/CDV	110/1735/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all the parts in the IEC 62341 series, under the general title *Organic light emitting diode (OLED) displays*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –

Part 6-1: Measuring methods of optical and electro-optical parameters

1 Scope

This part of IEC 62341 specifies the standard measurement conditions and measuring methods for determining the optical and electro-optical parameters of organic light emitting diode (OLED) displays. Except for the power consumption method, all methods are intended for unbounded input signals measured in the flat regions of the display in a dark room.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845, *International Electrotechnical Vocabulary – Part 845: Lighting*

IEC 62341-1-2, *Organic light emitting diode (OLED) displays – Part 1-2: Terminology and letter symbols*